The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently amended) An apparatus for fingerprint image acquisition comprising:

a waveguide, having an entrance edge and top and bottom surfaces;

a light source, configured to direct a light beam toward the entrance edge of the waveguide;

a skin contact layer, disposed at or near the top surface of the waveguide or bottom surface of the waveguide;

a holographic optical element (HOE), disposed at the top or at the bottom surface[[s]] of the waveguide, configured to diffract the light beam incident from the light source to the skin contact layer;

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer,

wherein the HOE includes

a layer comprising a grating; and

at least one supporting layer in contact with the said grating layer, wherein

the grating layer and the at least one supporting layer have substantially similar coefficients of thermal expansion or thermo-optic coefficients or both.

2. (Currently amended) An apparatus for image acquisition of topological features of the surface of skin comprising:

a waveguide, having an entrance edge and top and bottom surfaces;

a light source, configured to direct a light beam at the entrance edge of the waveguide;

a skin contact layer, disposed at or near the top surface or the bottom surface of the waveguide;

a holographic optical element (HOE), disposed at the top or at the bottom surface[[s]] of the waveguide, configured to diffract the light beam incident from the light source to the skin contact layer;

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer; and

means for compensating for changes in the Bragg matching condition of the HOE due to changes in temperature.

3. (Currently amended) The apparatus of Claim 2 wherein <u>the means for</u> compensating for temperature-induced changes in the Bragg matching condition of the HOE includes controlling the temperatures of the HOE.

4. (Currently ameded) The apparatus of Claim 2 wherein the means for compensating includes one or more means for adjusting the angle of incidence of the light beam from the light source at the waveguide or adjusting the angle between the entrance edge and the top or bottom surface[[s]] of the waveguide with respect to the angle of incidence of the beam directed from the light source at the waveguide, to compensate for change in the intensity of diffraction of light by the HOE due to temperature-induced change in the Bragg matching condition for the HOE.

5. (Original) The apparatus of Claim 2 wherein the HOE is configured to diffract the light beam in a direction that differs from the perpendicular to the skin contact layer by an angle that exceeds the angular width of the Bragg matching condition of the HOE.

6. (Currently amended) The apparatus of Claim 2 wherein the HOE is optimized for <u>an</u> s-polarized incident beam.

7. (Original) The apparatus of Claim 2 wherein the HOE is optimized for <u>a</u> p-polarized incident beam.

8. (Original) The apparatus of Claim 2 wherein the HOE is polarization independent.

9. (Original) The apparatus of Claim 2 further comprising a lens element configured to collimate and direct the light beam from the light source at the entrance edge of the waveguide,

wherein the means for compensating includes means for mounting one or more of the light source, the lens element or the waveguide, and wherein the means for mounting is thermally expandable and is configured to adjust the angle of incidence of the light beam onto the waveguide or the HOE.

10. (Original) The apparatus of Claim 9 wherein the means for mounting one or more of the light source, the lens element or the waveguide comprises a rod or bar.

11. (Original) The apparatus of Claim 2 wherein the means for compensating includes one or more actuators, configured to adjust the angle of incidence of the light beam onto the waveguide or the HOE.

12. (Original) The apparatus of Claim 11 wherein further including an optional lens element.

13. (Original) The apparatus of Claim 12 wherein the actuator adjusts the position of one or more of the light source, the lens element or the waveguide.

14. (Original) The apparatus of Claim 12 wherein the position of one or more of the light source, the lens element or the waveguide is manually controlled by measuring intensity of the light diffracted by the HOE and detected by one or more of a plurality of pixels of the sensor array.

15. (Original) The apparatus of Claim 13 wherein the actuator is electronically controlled.

16. (Original) The apparatus of Claim 15 wherein intensity of the light reaching one or more of a plurality of pixels of the sensor array is measured to provide a signal that is used to control the actuator.

17. (Currently amended) The apparatus of Claim ~~15~~ 16 wherein intensity of the light diffracted by the HOE and detected by the sensor array is measured to provide the signal that controls the actuator.

18. (Currently amended) The apparatus of Claim ~~15~~ 16 further including at least one second sensor and wherein the intensity of the light reaching the second sensor is measured to provide the signal that controls the actuator.

19. (Original) The apparatus of Claim 18 wherein the difference in intensities of the light diffracted by the HOE and the undiffracted light is measured to provide the signal that controls the actuator.

20. (Currently amended) The apparatus of Claim ~~15~~ 18 further including at least one additional hologram, spaced apart and disposed next to the HOE, said additional hologram configured to diffract a portion of the light incident on the HOE to the ~~additional~~ second sensor,

wherein measuring the intensity of the light diffracted from the additional hologram provides the signal to control the actuator.

21. (Currently amended) An apparatus for image acquisition of topological features of the surface of skin comprising:

a waveguide, having an entrance edge and top and bottom surfaces;

a light source, configured to direct a light beam at the entrance edge of the waveguide;

a skin contact layer, disposed at the top or bottom surface of the waveguide;

a holographic optical element (HOE), disposed at the top or at the bottom surface[[s]] of the waveguide, configured to diffract the light beam incident from the light source at the skin contact layer;

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer,

wherein the HOE includes at least two co-locationally multiplexed holograms.

22. (Original) The apparatus of Claim 21 wherein the multiplexed holograms are configured so that the Bragg matching condition of the multiplexed holograms is substantially overlapping.

23. (Original) The apparatus of Claim 21 wherein the multiplexed holograms are planar-angle multiplexed and wherein the increment of the recording angle for multiplexing is less than the width of the angle Bragg matching condition of each earlier-recorded multiplexed hologram.

24. (Original) The apparatus of Claim 21 wherein the grating periods of the multiplexed hologram are not equal.

25. (Currently amended) An apparatus for image acquisition of topological features of the surface of skin comprising:

a waveguide, having an entrance edge and top and bottom surfaces;

a light source, configured to direct a light beam at the entrance edge of the waveguide;

a skin contact layer, disposed at the top or bottom surface of the waveguide;

a holographic optical element (HOE), disposed at the top or at the bottom surface[[s]] of the waveguide, configured to diffract the light beam incident from the light source at the skin contact layer;

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer; and

~~means for changing the wavelength~~ a laser diode configured to change the operating wavelength of the light source in response to temperature-induced changes in the Bragg matching condition of the HOE.

26. (Canceled).

27. (Previously presented) The apparatus of Claim 25 wherein the HOE is configured to diffract the light beam in a direction that differs from the perpendicular to the skin contact layer by an angle that exceeds the angular width of the Bragg matching condition of the HOE.

28. (Previously presented) The apparatus of Claim 25 wherein the HOE is optimized for an s-polarized incident beam.

29. (Previously presented) The apparatus of Claim 25 wherein the HOE is optimized for a p-polarized incident beam.

30. (Previously presented) The apparatus of Claim 25 wherein the HOE is polarization independent.

31. (Currently amended) The apparatus of Claim 25 wherein the ~~means for compensating includes~~ light source is a multi-wavelength light source.

32. (Currently amended) An apparatus for image acquisition of topological features of skin surface,

comprising:

a waveguide, having an entrance edge and top and bottom surfaces;

a light source, configured to direct a light beam at the entrance edge of the waveguide;

a skin contact layer, disposed at the top surface of the waveguide;

a holographic optical element (HOE), disposed at the top or at the bottom surface[[s]] of the waveguide, configured to diffract the light beam at the skin contact layer and having a Bragg matching condition;

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer, and

means for compensating for changes in the Bragg matching condition of the HOE due to changes in temperature,

wherein the light source is a broad wavelength spectrum light source, the wavelengths of which can reconstruct the HOE.

33. (Original) The apparatus of Claim 32 further including a lens element, configured to direct the light beam from the light source at the entrance edge of the waveguide.

34. (Original) The apparatus of Claim 32 wherein the HOE is configured to diffract the light beam in a direction that differs from the perpendicular to the skin contact layer by an angle.

35. (Original) The apparatus of Claim 34 wherein the HOE has a diffraction efficiency of at least about 50%.

36. (Original) The apparatus of Claim 34 wherein the HOE has a diffraction efficiency of at least about 75%.

37. (Original) The apparatus of Claim 34 wherein the HOE has a diffraction efficiency of at least about 90%.

38. (Original) The apparatus of Claim 32 wherein the HOE includes at least two multiplexed holograms.

39. (Currently amended) The apparatus of Claim 32 wherein the HOE is optimized for <u>an</u> s-polarized incident beam.

40. (Currently amended) The apparatus of Claim 32 wherein the HOE is optimized for <u>a</u> p-polarized incident beam.

41. (Original) The apparatus of Claim 32 wherein the HOE is polarization independent.

42. (Original) The apparatus of Claim 32 wherein the entrance edge of the waveguide forms an oblique angle with the top and bottom surfaces.

43. (Original) The apparatus of Claim 34 wherein the light from the light source is directed at the entrance edge so that said light directly refracts to the HOE.

44. (Original) The apparatus of Claim 32 wherein the entrance edge has optical power and is configured to direct the light beam from the light source at the HOE.

45. (Original) The apparatus of Claim 32 wherein the waveguide includes light traps at the surface opposite to the entrance edge.

46. (Original) The apparatus of Claim 32 wherein the waveguide includes a reflective metal coating along its bottom surface at or near the entrance edge of the waveguide.

47. (Original) The apparatus of Claim 32 further including a wave plate configured to produce a direction of polarization that is optimal for diffraction by the HOE.

48. (Original) The apparatus of Claim 47 wherein the wave plate is a half-wave plate.

49. (Previously presented) The apparatus of Claim 48 wherein the half-wave plate is disposed between the light source and the entrance edge of the waveguide and configured to rotate the plane of polarization of the light beam so that it is optimal for diffraction by the HOE.

50. (Original) The apparatus of Claim 32 further including a linear polarizer disposed between the skin contact layer and the sensor array.

51. (Original) The apparatus of Claim 32 wherein the skin contact layer has a refractive index higher than about 1.3.

52. (Original) The apparatus of Claim 32 wherein the skin contact layer has a refractive index that is between about 1.30 and about 1.50.

53. (Original) The apparatus of Claim 32 wherein the skin contact layer comprises a portion having optical power configured to direct the light reflected from the interface between skin and the skin contact layer to the sensor array.

54. (Original) The apparatus of Claim 53 wherein the portion having optical power is curved.

55. (Original) The apparatus of Claim 53 wherein the portion having optical power is a plano-convex lens.

56. (Currently amended) The apparatus of Claim 32 further including ~~an additional~~ a lens element attached to the skin contact layer configured to direct the light reflected from the interface between skin and the skin contact layer to the sensor array.

57. (Previously presented) The apparatus of Claim 32 wherein the skin contact layer comprises a layer of a polymer having a glass transition temperature less than ambient use temperature of the device.

58. (Original) The apparatus of Claim 32 wherein the skin contact layer is coated with a layer of polymer having a glass transition temperature less than ambient use temperature of the device.

59. (Previously presented) The apparatus of Claim 32 wherein the skin contact layer comprises a glass material having a refractive index between about 1.45 and 1.50.

60. (Original) The apparatus of Claim 32 wherein the skin contact layer comprises a top surface having surface energy of less than about 30 mJ/m^2.

61. (Original) The apparatus of Claim 32 further including at least one of a ¼ wave plate and a linear polarizer disposed between the skin contact layer and the sensor array.

62. (Previously presented) The apparatus of Claim 61 wherein the ¼ wave plate is disposed between the HOE and the skin contact layer and the linear polarizer is disposed between the waveguide and the sensor array.

63. (Previously presented) The apparatus of Claim 32 wherein the light source wavelength is in a range from about 400 nm to about 1000 nm.

64. (Original) The apparatus of Claim 63 wherein the light source wavelength is in a range from about 400 nm to about 535 nm.

65. (Currently amended) The apparatus of Claim 32 wherein at least one of the surfaces of the waveguide[[,]] or the sensor array include an antireflection coating.

66. (Original) The apparatus of Claim 50 wherein at least one surface of the polarizer includes an antireflection coating.

67. (Original) The apparatus of Claim 32 wherein at least one of the surfaces of the waveguide, or the holographic optical element, or the sensor array, or the skin contact layer include a dielectric layer.

68. (Original) The apparatus of Claim 50 wherein at least one surface of the polarizer includes a dielectric layer.

69. (Previously presented) The apparatus of Claim 67 wherein the dielectric layer includes a polymeric film having a glass transition temperature less than ambient use temperature of the device.

70. (Currently amended) The apparatus of Claim ~~69~~ <u>68</u> wherein the dielectric layer includes derivatives of silicone or siloxane.

71. (Original) The apparatus of Claim 32 wherein the sensor array has a resolution of at least 1100 pixels per inch in the acquired image.

72. (Previously presented) The apparatus of Claim 32 wherein the sensor array is a CCD or CMOS imager.

73. (Previously presented) A method of acquiring an image of the topology of the surface of skin, comprising:

receiving a surface of skin by a device for image acquisition of the topological features of the surface of skin wherein said device includes a waveguide having an entrance edge and top and bottom surfaces, and a holographic optical element (HOE) having a Bragg matching condition;

directing a light beam at the HOE, thereby diffracting the light beam;

directing the diffracted light beam at the interface between skin and the skin contact layer, thereby reflecting the light beam;

compensating for temperature-induced changes in the Bragg matching condition of the HOE; and

detecting the reflected light, thereby acquiring the image of the topological features of the surface of skin by said device.

74. (Original) The method of Claim 73 wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes controlling the temperature of the HOE.

75. (Original) The method of Claim 73 wherein the HOE includes a diffraction grating having at least one dimension that is greater than the cross-section of the light beam, and

wherein the light beam is directed at the HOE at an angle that is less than about 90° with respect to the plane of the HOE, said HOE diffracting light at an angle that is less than the incident angle of the light directed at the HOE, thereby anamorphically expanding the light beam.

76. (Previously presented) The method of Claim 73 wherein the image acquisition device further includes

a skin contact layer disposed at the top surface of the waveguide;

a light source, configured to direct a light beam at the entrance edge of the waveguide; and

a sensor array, configured to detect light reflected from the interface between skin and the skin contact layer.

77. (Currently amended) The method of Claim 73 wherein the HOE includes a layer comprising a grating and at least one supporting layer in contact with said grating layer, and

wherein compensating for the temperature-induced changes in the Bragg matching condition of the HOE includes selecting ~~the~~ layers <u>of the HOE</u> to have substantially similar coefficients of thermal expansion or thermo-optic coefficient or both.

78. (Original) The method of Claim 76 wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes adjusting an angle of incidence of the light beam onto the HOE or the wavelength of the light beam.

79. (Previously presented) The method of Claim 78 wherein the image acquisition device further includes a lens element, configured to direct the light beam from the light source to the entrance edge of the waveguide and means for mounting one or more of the light source, the lens element or the waveguide, and

wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes selecting at least one of the mounting means to be thermally expandable and configuring the selected means to adjust the angle of incidence of the light beam onto the HOE.

80. (Original) The method of Claim 79 wherein the means for mounting the light source is a thermally expandable rod or bar.

81. (Original) The method of Claim 79 wherein the image acquisition device further includes a controllable actuator, configured to adjust an angle of incidence of the light beam onto the HOE.

82. (Currently amended) The method of Claim 76 wherein the position of one or more of the light source, ~~the~~ a lens element or the waveguide is manually controlled by measuring the intensity of the light diffracted by the HOE and detected by one or more of a plurality of pixels of the sensor array.

83. (Currently amended) The method of Claim 76 wherein the device further includes at least one additional sensor, and

further wherein the position of one or more of the light source, ~~the~~ a lens element or the waveguide is manually controlled by measuring the intensity of the light diffracted by the HOE and detected by the at least one additional sensor.

84. (Original) The method of Claim 81 wherein compensating for the temperature-induced changes in the Bragg matching condition of the HOE includes controlling the actuator by an electrical signal.

85. (Currently amended) The method of Claim 84 wherein the image acquisition device further includes at least one additional sensor, and

wherein controlling the actuator includes measuring intensity of the light reaching the sensor array or the at least one additional sensor, thereby providing the electrical signal.

86. (Original) The method of Claim 85 wherein controlling the actuator includes measuring intensity of the light diffracted by the HOE thereby providing the electrical signal.

87. (Original) The method of Claim 86 wherein controlling the actuator includes measuring the difference of the intensities of the light diffracted by the HOE and the undiffracted light thereby providing the electrical signal.

88. (Original) The method of Claim 84 wherein the image acquisition device further includes at least one additional hologram disposed next to the HOE, and

wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes measuring intensities of the light diffracted from the additional holograms thereby obtaining the electrical signal.

89. (Original) The method of Claim 84 wherein the HOE includes at least two co-locationally multiplexed holograms, and

wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes recording the multiplexed holograms so that the Bragg matching condition of the multiplexed holograms is substantially overlapping.

90. (Currently amended) The method of Claim 84 wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes recording ~~the~~ planar- angle multiplexed holograms so that the increment of the recording angle is less than the width of the Bragg angle selectivity of each multiplexed hologram.

91. (Currently amended) The method of Claim ~~84~~ 89 wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes recording the multiplexed holograms so that the grating periods of said holograms are not equal.

92. (Currently amended) The method of Claim ~~78~~ 76 wherein the light source is a laser diode, and

wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes configuring the laser diode to change the operating wavelength in response to temperature.

93. (Original) The method of Claim 76 wherein compensating for temperature-induced changes in the Bragg matching condition of the HOE includes configuring the light source to produce a broad wavelength spectrum light.

94. (Currently amended) The method of Claim 76 further including selecting the HOE that diffracts the light beam in a direction that differs from the perpendicular to the skin contact layer by an angle that exceeds the angular width of the Bragg angle selectivity of the ~~main~~ hologram.

95. (Original) The method of Claim 76 further including selecting the HOE that includes at least two multiplexed holograms.

96. (Currently amended) The method of Claim ~~94~~ <u>95</u> further including selecting the HOE so that each of the multiplexed holograms has a diffraction efficiency of at least about 50%.

97. (Currently amended) The method of Claim ~~94~~ <u>95</u> further including selecting the HOE so that each of the multiplexed holograms has a diffraction efficiency of at least about 75%.

98. (Currently amended) The method of Claim ~~94~~ <u>95</u> further including selecting the HOE so that each of the multiplexed holograms has a diffraction efficiency of at least about 90%.

99. (Original) The method of Claim 73 further including selecting the HOE that is optimized for s-polarized light.

100. (Original) The method of Claim 73 further including selecting the HOE that is optimized for p-polarized light.

101. (Original) The method of Claim 73 further including selecting the HOE that is polarization independent.

102. (Currently amended) The method of Claim ~~76~~ 73 further including selecting the waveguide having the entrance edge that forms an oblique angle with the top and the bottom surfaces.

103. (Currently amended) The method of Claim ~~76~~ 73 further including selecting the waveguide having the entrance edge that has optical power and thereby directing the light beam from the light source at the HOE.

104. (Currently amended) The method of Claim ~~76~~ 73 further including selecting the waveguide having light traps at the surface opposite to the entrance edge.

105. (Currently amended) The method of Claim ~~76~~ 73 further including selecting the waveguide having a reflective metal coating along its bottom surface at or near the entrance edge of the waveguide.

106. (Previously presented) The method of Claim 76 further including directing the light beam through a wave plate disposed between the light source and the entrance edge of the waveguide and configured to produce a direction of polarization that is optimal for diffraction by the HOE.

107. (Original) The method of Claim 106 wherein the wave plate is a half-wave plate.

108. (Original) The method of Claim 76 further including selecting the skin contact layer that has optical power thereby directing the light reflected from the interface between skin and the contact layer at the sensor array.

109. (Original) The method of Claim 76 wherein the image acquisition device further includes a lens element attached to skin contact layer configured to direct the light reflected from the interface between skin and the contact layer at the sensor array.

110. (Previously presented) The method of Claim 76 wherein the skin contact layer comprises a layer of a polymer having a glass transition temperature less than an ambient use temperature of the device.

111. (Original) The method of Claim 76 wherein the skin contact layer is coated with a layer of polymer having a glass transition temperature less than ambient use temperature of the device.

112. (Previously presented) The method of Claim 76 wherein the skin contact layer comprises a glass material having a refractive index between about 1.45 and 1.50.

113. (Original) The method of Claim 76 wherein the skin contact layer comprises a top surface having surface energy of less than about 30 mJ/m^2.

114. (Original) The method of Claim 76 further including at least one of a 1/4 wave plate and a linear polarizer disposed between the skin contact layer and the sensor array.

115. (Original) The method of Claim 114 wherein the 1/4 wave plate is disposed between the HOE and the skin contact layer and the linear polarizer is disposed between the waveguide and the sensor array.

116. (Previously presented) The method of Claim 76 wherein the light source wavelength is in a range from about 400 nm to about 1000 nm.

117. (Original) The method of Claim 116 wherein the light source wavelength is in a range from about 400 nm to about 535 nm.

118. (Original) The method of Claim 76 wherein at least one of the surfaces of the waveguide, or the sensor array include an antireflection coating.

119. (Original) The method of Claim 114 wherein at least one surface of the polarizer includes an antireflection coating.

120. (Original) The method of Claim 76 wherein at least one of the surfaces of the waveguide, or the holographic optical element, or the sensor array, or the skin contact layer include a dielectric layer.

121. (Original) The method of Claim 114 wherein at least one surface of the polarizer includes a dielectric layer.

122. (Currently amended) The method of Claim ~~120~~ 121 wherein the dielectric layer includes a polymeric film having a glass transition temperature less than ambient use temperature of the device.

123. (Currently amended) The method of Claim ~~122~~ 121 wherein the dielectric layer includes derivatives of silicone or siloxane.

124. (Original) The method of Claim 76 wherein the sensor array has a resolution of at least 1100 pixels per inch.

125. (Previously presented) The apparatus of Claim 32 wherein the light source is a light emitting diode (LED).